07/15/99 JC02 U.S. PTO

JC136 U.S.PTO 09/353998 07/15/99

LIMBACH & LIMBACH L.L.P.
2001 Ferry Building, San Francisco, CA 94111
415/433-4150

Address to:
Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Attorney's Docket No. SONY-P9817
[S99P0817US00]
First Named Inventor SUSUMU SENSYU

UTILITY PATENT APPLICATION TRANSMITTAL
(under 37 CFR 1.53(b))

SIR:

Transmitted herewith for filing is the patent application entitled:
OPTICAL DISC, METHOD OF WRITE TO SAME AND METHOD OF READ FROM SAME

CERTIFICATION UNDER 37 CFR § 1.10

I hereby certify that this New Application and the documents referred to as enclosed herein are being deposited with the United States Postal Service on this date July 15, 1999, in an envelope bearing "Express Mail Post Office To Addressee" Mailing Label Number EL254064543US addressed to: Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

Howard Wong
(Name of person mailing paper) (Signature)

Enclosed are:

1. X Transmittal Form (two copies required)

2. The papers required for filing date under CFR § 1.53(b):
   i. 28 Pages of specification (including claims and abstract);
   ii. 14 Sheets of drawings.
   __ formal x informal

3. Declaration or oath

   a. x Unsigned

ACCOMPANYING APPLICATION PARTS

4. __ An assignment of the invention to Sony Corporation is attached (including Form PTO-1595).

   i. __ 37 CFR 3.73(b) Statement (when there is an assignee)

5. x Power of Attorney (Unsigned)

6. __ An Information Disclosure Statement (IDS) is enclosed, including a PTO-1449 and copies of __ references.

7. __ Preliminary Amendment.

8. X Return Receipt Postcard (MPEP 503 -- should be specifically itemized)

9. __ Other

10. FOREIGN PRIORITY
    [x] Priority of application no. P10-219582 filed on July 17, 1998 in Japan is claimed under 35 USC 119.

    The certified copy of the priority application:
    x is filed herewith; or
    - has been filed in prior application no. _ filed on _, or
    - will be provided.

    __ English Translation Document (if applicable)

11. **FEE CALCULATION**

a. __ Amendment changing number of claims or deleting multiple dependencies is enclosed.

CLAIMS AS FILED

	Number Filed	Number Extra	Rate	Basic Fee ($760)
Total Claims	9 - 20	* 0	x $18.00	0
Independent Claims	6 - 3	* 3	x $78.00	234.00
x Multiple dependent claim(s), if any			$260.00	260.00

*If less than zero, enter "0".

Filing Fee Calculation $1,254.00

50% Filing Fee Reduction (if applicable) . . . . . $

12. Small Entity Status
   a. __ A small entity statement is enclosed.
   b. __ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
   c. __ is no longer claimed.

13. Other Fees
   __ Recording Assignment [$40.00] $0
   __ Other fees
   Specify _____ $0

Total Fees Enclosed $1,254.00

14. Payment of Fees
   x Check(s) in the amount of $ 1,254.00 enclosed.
   __ Charge Account No. 12-1420 in the amount of $__.
   A duplicate of this transmittal is attached.

15. All correspondence regarding this application should be forwarded to the undersigned attorney:

Charles P. Sammut
Limbach & Limbach L.L.P.
2001 Ferry Building
San Francisco, CA 94111
Telephone: 415/433-4150
Facsimile: 415/433-8716

16. Authorization to Charge Additional Fees

X The Commissioner is hereby authorized to charge any additional fees (or credit any overpayment) associated with this communication and which may be required under 37 CFR § 1.16 or § 1.17 to Account No. 12-1420. **A duplicate of this transmittal is attached**.

LIMBACH & LIMBACH L.L.P.

July 15, 1999
(Date)

By: _____
Charles P. Sammut
Registration No. 28,901
Attorney(s) or Agent(s) of Record

Attorney Docket No. SONY-P9817
[S99P0817US00]

TITLE OF THE INVENTION

Optical Disc, Method of Write to Same and Method of Read from Same

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an optical disc improved in data format including a user data, ID information and control information, a method of write to the optical disc and a method of read from the optical disc.

2. Description of Related Art

FIG. 1 schematically shows the data format on a conventional optical disc.

In the conventional optical disc, a user data, ID information and control information are coded as one block for error correction, and the coded data are modulated, and a sync signal added to the modulated data for write to the optical disc. Generally, the user data has been pre-coded for an error correction (EDC is added to the user data) separately from the above-mentioned error-correcting coding.

In FIG. 1, the hatched portion of the ECC structure indicates a parity, and the hatched portion of the physical structure indicates an FS (frame sync signal).

FIG. 2 shows a data format for a DVD, as an example. In this data format, one sector contains a 2-kB user data, control and ID information, and EDC. One block consists of 16 sectors, and an information word containing 16 sectors of user data, control and ID information and EDC is coded for error correction (parity is

added). In the DVD, RSPC (Reed Solomon product code) is used as correcting code (in this respect, this data format for the DVD is difference from that shown in FIG. 1). Assume here that the line direction is C1 and row direction is C2. C1 is RS (182, 172, 11) while C2 is RS (208, 192, 17).

The ECC block is configured as follows:

User data	2048
EDC	4
Control information	6
ID information	6
Total	2064 × 16

One block of data corresponds to 16 sectors. One sector on the optical disc is composed of 26 frames each consisting of a 91-byte data. Two frames correspond to a C1 correcting code. Twenty six frames forming one sector on the optical disc correspond to thirteen C1 correcting codes, and contain 12 lines for an information word in the C2 correcting code direction and one line for the parity word.

For read from the optical disc, an FS signal is used for frame synchronization, then ID information is used for sector synchronization. Thus, data position in one block is known. So, the ID information has to be disposed in a direction of data on the optical disc. Also, it has to be disposed in the same position in each physical sector. FIG. 3 shows the ID information positioned at the

head of each physical sector, for example. On the DVD, the direction of user data is the same as on the optical disc. It should be noted that the operations such as scramble will not be described herein.

Recently, an optical disc having a lager capacity and higher transfer rate and a disc drive for such an optical disc are demanded for use to store dynamic images, etc. In particular, recordable type and rewritable disc systems have to be of a rather large capacity to assure a sufficient quality of an image since the image information cannot easily be real-time compressed at a high efficiency, which depends upon the content thereof. For such a larger capacity of the optical disc, there are available methods such as increased NA (numerical aperture) of the optical system for data write and/or read and decrease in thickness of the disc substrate to assure a sufficient skew margin, etc. However, since the increase of capacity will lead to a higher recording density of the optical disc and the decrease of the disc will cause the disc to be adversely affected by dust, it is desirable to assure the larger capacity of the optical disc by improving the capability of error correction. The optical disc should desirably be strong again a burst error among others. On the other hand, for a larger capacity of the optical disc, the coding efficiency should not be much low. For these purposes, it has been proposed to enlarge the error-correcting code, namely, increase the size of ECC block. However, it is difficult to use the normally used PC (product code) of GF (2^8) in a larger ECC block than used in the DVD technology, for example, an ECC block containing more than 64 kB of user data.

An ECC block in which an LDC (long distance code; one-directional correcting code of a long distance (having many parities) is configured with a deep interleave is more suitably usable in these situations.

LDC is advantageous in that the time required for correcting operation is shorter since a single pass of correction is only required basically and write and read can be done with a high efficiency since output simultaneous with a correcting operation is enabled by disposing the direction of user data in the same direction as error-correcting code. With the user data disposed in the same direction as the error-correcting code, an error which could not be corrected can be prevented from being dispersed into a plurality of logical sectors. Because of this fact, the user code should preferably be arranged in the same direction as the error-correcting code. For use of LDC, the error-correcting code direction is set orthogonal (interleaved) to the disc direction to enhance the resistance of the optical disc against burst error. In effect, the error-correcting code should be disposed in the same direction as the user data direction but in a different direction from the disc direction.

FIG. 4 shows an example of the conventional data format to a large-capacity optical disc. In this data format, one logical sector contains a 2-kB user data, control information and EDC, and one block consists of 32 logical sectors and ID information. The block is formed from an information word consisting of the 32 logical sectors of user data (equivalent to 64 kB), control information, EDC and ID

information and which is coded for error correction (parity is added). The code used is LDC.

The above can be expressed as follows:

User data	2048
EDC	4
Control information	22
ID information	6
Total	2070 × 32

This content is disposed in the ECC block , and can be represented by RS (240, 208, 33) × 320.

One block of data equivalent to 32 physical sectors on the optical disc. One physical sector on the optical disc consists of 10 frames each of 240-byte data.

For read from the optical disc, an FS signal is used for frame synchronization, then ID information is used for sector synchronization. Thus, data position in one block is known. So, the ID information has to be disposed in a direction of data on the optical disc. Also, it has to be disposed in the same position in each physical sector, and also in the same position in each of the physical sectors. As shown in FIG. 5, the ID information is positioned at the head of each physical sector, for example.

The user data should desirably be disposed in the same direction as on the optical disc. As seen from FIG. 4, however, the ID information interferes with this

positioning so that it is difficult to dispose the logical sector in the direction of the error-correcting code. Also, a physical sector full of parity word because no ID information cannot be placed in that physical sector. Therefore, limitations have to be imposed to the data formatting so that information word and parity word can be positioned evenly in each of the physical sectors.

As mentioned above, for providing a large-capacity, high transfer-rate optical disc format and optical disc drive, it may be possible to provide the interleave length, enhance the error-correcting capability by using an error-correcting code of a large code distance (LDC) and raise the writing and reading speed by disposing error-correcting code in the same direction as user data. In this case, however, since parities in ID information and user data interference with each other, it is not easy to form such a data format.

SUMMARY OF THE INVENTION

Accordingly, the present invention has an object to overcome the above-mentioned drawbacks of the prior art by providing an optical disc whose the data format including a user data, ID information and control information is improved so that a same direction can be selected for disposition of the user data and control information as well as for error-correcting code with no care about parities in the error-correcting codes for the ID information and user data, a method of write to the optical disc and a method of read from the optical disc.

The above object can be attained by providing an optical disc having a data

format in which a user data and a control information in a logical sector are disposed in block, and an ID information in a physical sector is disposed in the other block, and they are coded for error correction.

Further, the above object can be attained by providing an optical disc having a data format in which a user data, a control information in a logical sector and an ID information in a physical sector are disposed each in one block, and they are coded for error correction.

Still further, the above object can be attained by providing an optical disc having a data format in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error correction.

Yes further, the above object can be attained by providing an optical disc having each of the data formats in which an error-correcting code whose code distance is long (LDC) in one direction and the user data is arranged in the same direction as the error-correcting code.

Also the above object can be attained by providing a method of write to an optical disc in a data format in which a user data, a control information in a logical sector, and an ID information in a physical sector are disposed each in one block, and they are coded for error correction, or in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error

correction, the method comprising, according to the present invention, the steps of:

combining a control information from an application program with other control information (inherent control information including a drive ID, disc ID, etc.) or converting the information in an optical disc drive; and

encrypting or scrambling the user data with the control information thus combined or converted.

Further, the above object can be attained by providing a method of write to an optical disc in a data format in which a user data, a control information in a logical sector, and an ID information in a physical sector are disposed each in one block, and they are coded for error correction, or in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error correction, the method comprising, according to the present invention, the steps of:

combining a control information from an application program with other control information (inherent control information including a drive ID, disc ID, etc.) or converting the information in an optical disc drive; and

writing to the optical disc the information thus combined or converted as a block of control information.

Still further, the above object can be attained by providing a method of reading data from an optical disc having a data format in which a user data, a control information in a logical sector, and an ID information in a physical sector

are disposed each in one block, and they are coded for error correction, or in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error correction, the method comprising, according to the present invention, the steps of:

decrypting ore descrambling the intra-block control information corresponding to the control information in the data format in the block while sending in any other format the intra-block control information corresponding to the control information in the data format to the application program.

These objects and other objects, features and advantages of the present intention will become more apparent from the following detailed description of the preferred embodiments of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically illustrates a data format for write/read to/from the conventional optical disc;

FIG. 2 is shows a data format for write/read to/from DVD;

FIG. 3 shows a data format in which ID information is positioned at the head of each physical sector;

FIG. 4 shows a conventional data format applied to a large-capacity optical disc;

FIG. 5 shows a conventional data format in which ID information is positioned at the head of each physical sector;

FIG. 6 schematically illustrates a data format in which a user data is disposed in one block, and a control information and ID information are disposed in the other block;

FIG. 7 schematically illustrates a data format in which a user data, a control information, and an ID information are positioned in separate blocks, respectively;

FIG. 8 schematically illustrates a data format in which a user data and control information are disposed in one block, and an ID information is disposed in the other block;

FIG. 9 shows an example of the data format in FIG. 6 applied to a large-capacity optical disc;

FIG. 10 shows an ECC block 2 which ID information used for synchronization and addressing of physical sector forms separately from the user data and control information;

FIG. 11 shows, by way of example, the configuration of a data format in which ID information is positioned at the head of each physical sector;

FIG. 12 shows, by way of example, the configuration of a data format in which information word in an ECC block 1 are allocated to the former physical sectors while parity word is allocated to the latter physical sectors;

FIG. 13 shows, by way of example, the configuration of a data format in

which information word in the ECC block 1 and parity word are allocated to one frame;

FIG. 14 shows an example of the data format in FIG. 7 applied to a large-capacity optical disc;

FIG. 15 shows the configuration of the ECC block 2;

FIG. 16 shows the configuration of an ECC block 3;

FIG. 17 shows a physical data configuration on the optical disc;

FIG. 18 shows, by way of example, the configuration of a data area on recordable type and rewritable type optical discs;

FIG. 19 is a block diagram of a data processing block of a disc drive for a read-only optical disc;

FIG. 20 is a block diagram of a data processing block for data output during error detection; and

FIG. 21 is a block diagram of a data processing block of a disc drive for a recordable type and rewritable type optical discs.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

According to the present invention, an ID information, user data and a control information are disposed each in one block, and coded for error correction.

As shown in FIG. 6, for example, the user data and control information are disposed in an ECC block 1, while the ID information is disposed in an ECC block 2. The ECC blocks 1 and 2 are coded independently for error correction. Each of

the ECC blocks thus coded (parity is added) for error correction is disposed in one physical structure, data is modulated, a sync signal is added to the modulated data, and then the data is written to the optical disc.

Generally, the user data has been pre-coded for an error correction (EDC is added to the user data) separately from the above-mentioned error-correcting coding as having previously been described with reference to FIG. 1.

In FIG. 6, the hatched portion of the ECC structure indicates a parity and that of the physical structure indicates FS (frame sync signal). The ID information, control information and the user data are disposed each in one block, and coded for error correction.

As shown in FIG. 7, the user data is disposed in the ECC block 1, the control information is in the ECC block 2, and the ID information is in an ECC block 3. The ECC blocks 1 to 3 are coded independently for error correction. The ECC blocks thus coded for error correction (parity is added) are disposed in one physical structure, data is modulated, a sync signal is added to the modulated data, and then the data is written to the optical disc.

Generally, the user data has been pre-coded for an error correction (EDC is added to the user data) separately from the above-mentioned error-correcting coding. The hatched portion of the ECC structure in FIG. 7 indicates a parity and that of the physical structure indicates FS (frame sync signal).

The EDC is handled as a control information, not as a user data, in some

methods. In this case, the EDC is handled in the same manner as a control information and disposed in the ECC block 2 although the above-mentioned EDC is handled as a user data and disposed in the ECC block 1 as shown in FIG. 7.

If the control information is not required in logical sectors but in blocks, or if the control information can easily disposed the same block even when it is required in logical sectors, ID and control information may be disposed in the same ECC block. In this case, the user data is disposed in the ECC block 1 while the ID and control information are disposed in the ECC block 2, as shown in FIG. 8.

The ECC blocks 1 and 2 are coded independently for error correction. Each of the ECC blocks thus coded for error correction (parity is added) are disposed in one physical structure, data is modulated, a sync signal is added to the modulate data, and the data is written to the optical disc.

In FIG. 8, the hatched portion of the ECC structure indicates a parity and that of the physical structure indicates FS (frame sync signal).

Since generally the user data has been pre-coded for an error correction (EDC is added to the user data) separately from the above-mentioned error-correcting coding, there are two possible cases: EDC is included in the user data in the logical structure, namely, in the ECC block 1 in the ECC structure, and EDC is included in the control information in the logical structure, namely, in the ECC block 2 in the ECC structure, as shown in FIG. 8.

With the blocks being independent of each other depending upon the content

of the information as in the above, they can be composed with no care about a possible mutual influence of them.

For example, the same direction of the user data and control information as that of the error-correcting code can be selected with no care about the ID information. Also, the control information can be handled differently by making it independent of the user data. For example, direct access to the control information from the user can be avoided.

Next, the data format in FIG. 7 will be described below concerning its configuration with reference to FIGS. 9 to 13.

As shown, one logical sector includes 2-kB (2048) user data, 18-byte control information and 4-byte EDC. The ECC block 1 consists of 32 logical sectors, the information word containing the logical sectors of user data (equivalent to 64 kB), control information and EDC being coded for error correction (parity is added). A code used for the ECC block 1 is RS (239, 207, 33). The codes count 320 in number as shown in FIG. 9.

The above can be expressed as follows:

User data	2048
EDC	4
Control information	18
Total	2070 × 32

This is disposed in the ECC block 1, and can be represented with RS (239,

207, 33) × 320.

The data in the ECC block 1 are equivalent to 32 physical sectors on the optical disc. The ID information used for synchronizing and addressing these physical sectors is disposed in the ECC block 2 as shown in FIG. 10 separately from the user data and control information. The ECC block 2 consists of 32 physical sectors of 6-byte ID information, the information word being coded for error correction (parity is added). The code used for the ECC block 2 is RS (10, 6, 5), for example, and the codes count 32 in number.

The data content of the ID information is 6 × 32. This is disposed in the ECC block 2 and can be represented with RS (10, 6, 5) × 32

One physical sector on the optical disc consists of 10 frames each of 240-byte data.

For read from the optical disc, an FS signal is used for frame synchronization, then ID information is used for sector synchronization. Thus, data position in one block is known. So, the ID information has to be disposed in a direction of data on the optical disc. Also, it has to be disposed in the same position in each physical sector, and also in the same position in each of the physical sectors. Even in the configuration shown in FIG. 11 for example, the ID information is positioned at the head of each physical sector. However, since the ECC blocks 1 and 2 are independent of each other, the logical sector can be composed with no care about of the ID information.

The error-correcting code and data in the logical sector can be disposed in the same direction (as the user data, control information).

It should be noted that the operations such as scrambling will be described herein.

As shown in FIG. 11, the information word and parity word of the ECC block 1 are allocated to each physical sector. Since the data in the ECC block 1 may be disposed in the total of the 32 logical sectors, however, the information word of the ECC block 1 may be allocated to the former physical sectors while the parity word may be allocated to the latter physical sectors as shown in FIG. 12.

Also, if the rule of interleaving is met, the data may be disposed in the ECC block 1 to be oblique to the data direction on the optical disc. In the physical structure, the information word and parity word of the ECC block 1 will be allocated in the frame as shown in FIG. 13. The data from the ECC block 2 may be of 1 byte at the head of each frame. There is no problem since one code (equivalent to one physical sector of ID information) in the ECC block 2 containing the ID information is complete with one physical sector and the ID information is disposed in a fixed position within the physical sector.

As having been described in the above, no care is required about the disposition of the information word and parity word in an area corresponding to the ECC block 1.

Next, the data format in FIG. 8 will be described below concerning its

configuration with reference to FIGS. 14 to 16.

As shown, one logical sector includes 4-kB (4096) user data, 24-byte control information and 4-byte EDC. The ECC block 1 consists of 32 logical sectors of user data including EDC, and the ECC block 2 consists of 16 logical sectors of control information. The information word in each block is coded for error correction (parity is added). A code used for the ECC block 1 is RS (237, 205, 33). The codes count 320 in number as shown in FIG. 14.

The above can be expressed as follows:

User data	4096
EDC	4
Total	4100 × 16

This is disposed in the ECC block 1, and can be represented with RS (237, 205, 33) × 320.

A code used in the ECC block 2 is RS (80, 48, 33), and the codes count 8 in number as shown in FIG. 15.

The above can be expressed as follows:

24 × 16

This is disposed in the ECC block 1, and can be represented with RS (80, 48, 33) × 8.

The data in the ECC blocks 1 and 2 are equivalent to 32 physical sectors on the optical disc. The ID information used for synchronizing and addressing these

physical sectors is disposed in the ECC block 3 separately from the user data and control information. The ECC block 3 consists of 32 physical sectors of ID information, and the information word is coded for error correction (parity is added). A code used for the ECC block 3 is RS (10, 6, 5), for example, and the codes count 32 in number as shown in FIG. 16.

The ID information has a content of 6×32 , and disposed in the ECC block 2. This can also be represented with RS (10, 6, 5) $\times$ 32

One physical sector on the optical disc consists of 10 frames each of 240-byte data as shown in FIG. 17.

For read from the optical disc, an FS signal is used for frame synchronization, then ID information is used for sector synchronization. Thus, data position in one block is known. So, the ID information has to be disposed in a direction of data on the optical disc. Also, it has to be disposed in the same position in each physical sector, and also in the same position in each of the physical sectors. However, since the ECC blocks 1 and 2 are independent of the ECC block 3, the logical sector can be composed with no care about of the ID information.

The error-correcting code and data in the logical sector can be disposed in the same direction (as the user data, control information).

The ECC blocks 1 and 2 are easy to handle independently. For example, the ECC block 2 can be made inaccessible from the user by making the ECC block 1

inaccessible directly from the user,

It should also be noted that the operations such as scrambling will not be described herebelow.

The ID information having been described in the above concerns an address information destined for locating a physical sector. If an address information for a logical sector is necessary, it may be included in a separate control information.

To change a user data by a control information, for example, to encrypt or scramble a user data by a control information, an error-correcting code for an ECC block also including a control information should have a higher capability than a error-correcting code for an ECC block including a user data.

Also, if EDC is included in a control information and it is judged in the EDC whether a final user data is erroneous or not, an error-correcting code for an ECC block including the EDC should have a higher capability than an error-correcting code for an ECC block including a user data. For such a higher capability of error correction, interleave length is increased until it goes over one block and the code is shortened with the code distance kept unchanged as for an ECC block of a user data. In case EDC exists, not as a control information, in a block also including a user data, the error-correcting code for an ECC block including a control information may not have a higher capability than that for an ECC block including a user data.

Since ID information can be checked for continuity for synchronization and

access, an error-correcting code for an ECC block including the ID information may not have high capability. Generally, the ID information should rather desirably be readable and detectable (correctable) for error at high speed. For the synchronization, ID information should desirably be readable and detectable/correctable for error at least within a physical block. That is, an error-correcting code for ID information should be completed in a sector in the direction of the optical disc.

In case the direction of an error-correcting code (code direction) suitable for control information is different from a code direction suitable for ID information as mentioned above and the control and ID information are to be disposed in the same ECC block as shown in FIG. 8, a code suitable for the ID information, for example, is generated (IDE is added to ID) and thereafter the code is coded along with the control information in a code direction suitable for the control information to compose the ECC block 2.

A read-only optical disc has a repetition of data area (frame group) formed according to the aforementioned data format. A user data part provides a desired data. Write is made by embossed pits.

To write a desired data in a desired position or to read a desired data from a desired position in a recordable type and rewritable type optical discs, addressing is effected using pre-address part pre-formed on the optical disc.

For example, an optical disc is divided into physical sectors in each of which

an address is pre-recorded. Addressing is made using the pre-recorded address to write or read data from each physical sector. For this purpose, a data part to write or read consists of APC area, VFO, SS, data area (frame group) and PO as shown in FIG. 18.

The data area is divided into physical sectors. The APC (automatic power control) area is to control the read laser power. The VFO area is to use PLL (phase-locked loop) for extraction of a clock for reading. The SS (sector sync) area provides a sync signal for a physical sector. The PO (postamble) area is a supplement data following a data. Since writing operation (data) and reading operation (data) are parted by each pre-recorded address, APC, VFO and SS are required for each physical sector.

In effect, each of recordable type and rewritable type optical discs has a pre-recorded address area, data area and a gap between the areas.

By using a same data format in the data areas of a read-only optical disc and recordable and rewritable type optical discs, respectively, the optical disc drives for these types of optical discs can use a same circuit related to the data format, so that the same optical disc drive can be used with all such types of optical discs.

FIG. 19 shows a data processing block of a read-only optical disc drive. The data processing block will be described concerning an optical disc having a data format as shown in FIG. 6.

A synchronization/demodulation circuit 11 synchronizes frames,

demodulates data, and synchronizes sectors. For the sector synchronization, ID information is detected or corrected for any error. Namely, the ECC block 2 is decoded. The synchronized and demodulated data is supplied to a memory 13 via an arbiter 12. When data for one block has been put into the memory 13, a data processor 14 corrects a user data for any error. Namely, the ECC block 1 is decoded, descrambled, and then detected by EDC.

If the error-correcting code and EDC have a same direction, data corrected for error in the data processor 14, descrambled data, and data detected for error by EDC can collectively be put in series into the memory 13 without write or read at each time.

If the control information is disposed in the ECC block as shown in the example in FIG. 7, the control information can be corrected for error before a user data is so that the user data can collectively be processed in series as in the above, since a necessary control information and EDC (code) for error correction of the user data is readily usable owing to the completed correction of the control information. A user data subjected to necessary processes such as error correction, descrambling and error detection/correction by EDC is written into the memory 13. When it is found as a result of the error detection by EDC that the user data is not erroneous, the data is sent to an I/F circuit 15 from the memory 13.

If data may be outputted in the course of a error detection by EDC, it may first be delivered directly without write into the memory 13 as shown in FIG. 20.

In the recordable type and rewritable type optical disc drive, a data part including data area (frame group) is controlled based on information from a pre-recorded address as shown in FIG. 21.

Data reading is effected through the blocks configured as in FIG. 19 except that synchronization can be attained with a timing signal from a pre-address reading/timing generation circuit 20 and sync signals such as SS and FS. Data write is effected by a modulation/sync pattern addition circuit 21 in each data area with a timing signal from the pre-address reading/timing generation circuit 20.

The modulation/sync pattern addition circuit 21effect encoding, modulation, addition of sync signal, and addition of APC, VFO and PO patterns in an opposite order to that for data read.

As having been described in the foregoing, when formed independently of each other depending upon the content of information in them, the ECC blocks will not influence each other, For example, a user data and control information can be disposed in the same direction as an error-correcting code with no care about the parity in each of ID information and user data.

Also, control information can be made independently of user data for handling them in different manners, respectively. For example, direct access to them from the user can thus be avoid.

Further, particular numerical values can easily be selected for composition of a data format.

WHAT IS CLAIMED IS:

1. An optical disc having a data format in which a user data and a control information in a logical sector are disposed in block, and an ID information in a physical sector is disposed in the other block, and they are coded for error correction.

2. An optical disc having a data format in which a user data, a control information in a logical sector and an ID information in a physical sector are disposed each in one block, and they are coded for error correction.

3. An optical disc having a data format in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error correction.

4. The optical disc as set forth in any of Claims 1 to 3, having each of the data formats in which an error-correcting code whose code distance is long (LDC) in one direction and the user data is arranged in the same direction as the error-correcting code.

5. A method of write to an optical disc in a data format in which a user data, a control information in a logical sector, and an ID information in a physical sector are disposed each in one block, and they are coded for error correction, or in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they

are coded for error correction, the method the steps of:

combining a control information from an application program with other control information (inherent control information including a drive ID, disc ID, etc.) or converting the information in an optical disc drive; and

encrypting or scrambling the user data with the control information thus combined or converted.

6. A method of write to an optical disc in a data format in which a user data, a control information in a logical sector, and an ID information in a physical sector are disposed each in one block, and they are coded for error correction, or in which a user data is disposed in one block, and a control information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error correction, the method the steps of:

combining a control information from an application program with other control information (inherent control information including a drive ID, disc ID, etc.) or converting the information in an optical disc drive; and

writing to the optical disc the information thus combined or converted as a block of control information.

7. A method of reading data from an optical disc having a data format in which a user data, a control information in a logical sector, and an ID information in a physical sector are disposed each in one block, and they are coded for error correction, or in which a user data is disposed in one block, and a control

information in a logical sector and an ID information in a physical sector are disposed in the other block, and they are coded for error correction, the method comprising, according to the present invention, the steps of:

decrypting ore descrambling the intra-block control information corresponding to the control information in the data format in the block while sending in any other format the intra-block control information corresponding to the control information in the data format to the application program.

ABSTRACT OF THE DISCLOSURE

An ID information, user data, and a control information are disposed each in one block, and coded for error correction. The user data and control information are disposed in an ECC block 1, while the ID information is disposed in an ECC block 2. The ECC blocks 1 and 2 are coded separately for error correction. The blocks thus coded for error correction are disposed in one physical structure, data is modulated, a sync signal is added to the modulated data, and then the data is written to an optical disc having the above data format.

6657270 "66655660

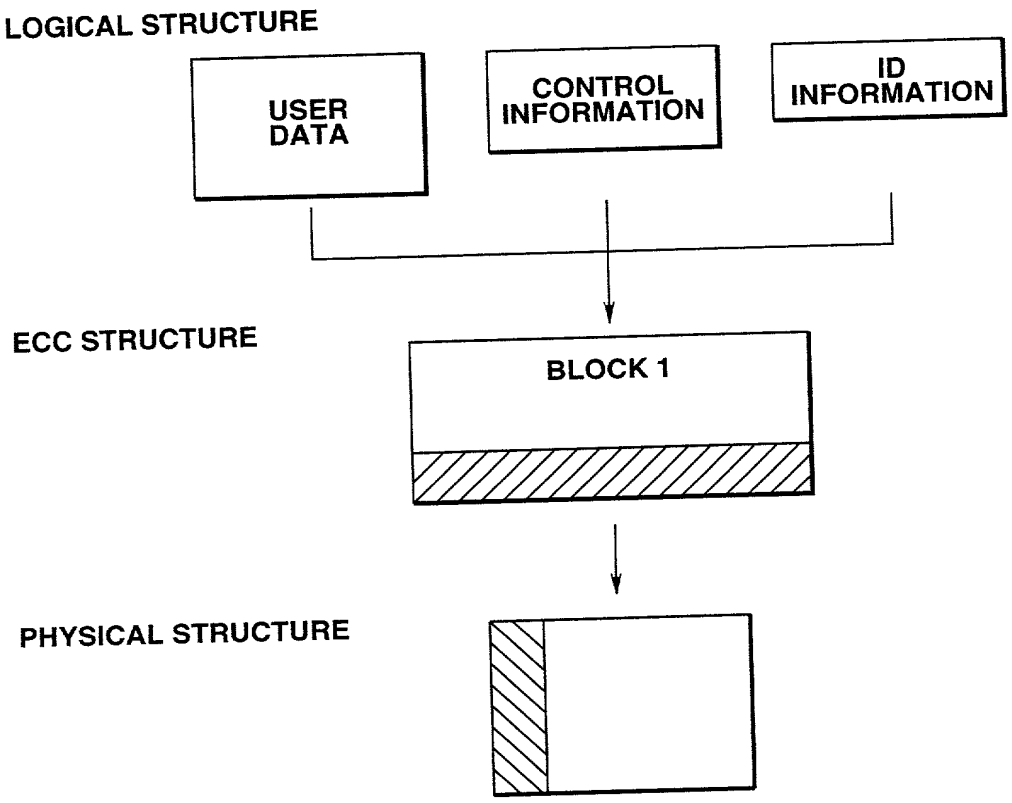
LOGICAL STRUCTURE
USER DATA
CONTROL INFORMATION
ID INFORMATION
ECC STRUCTURE
BLOCK 1
PHYSICAL STRUCTURE

FIG.1

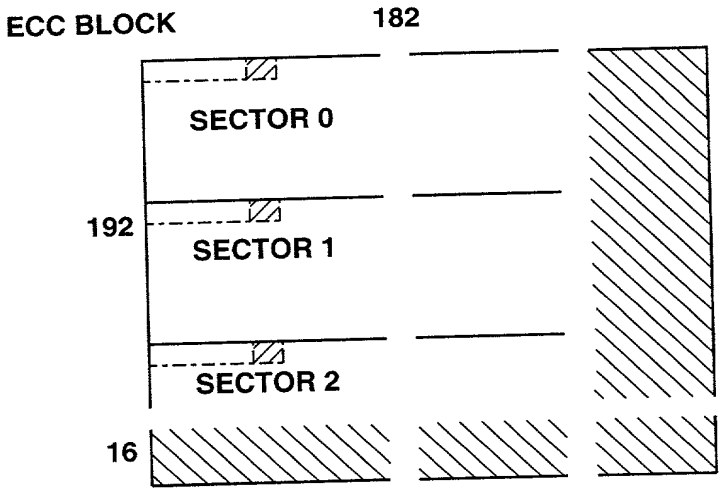
ECC BLOCK
182
SECTOR 0
192
SECTOR 1
SECTOR 2
16

FIG.2

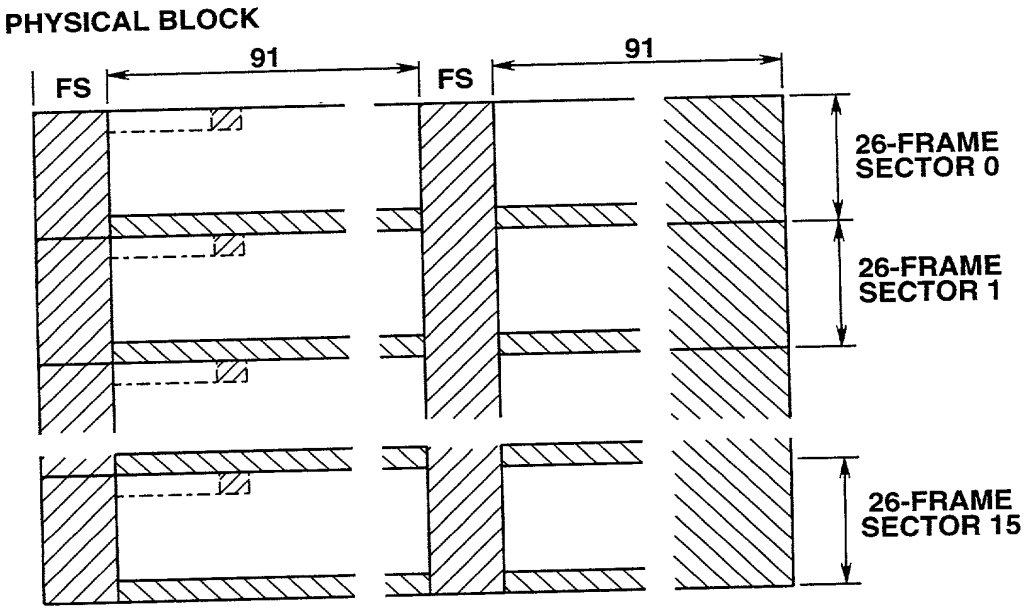
PHYSICAL BLOCK
91
91
FS
FS
26-FRAME
SECTOR 0
26-FRAME
SECTOR 1
26-FRAME
SECTOR 15

FIG.3

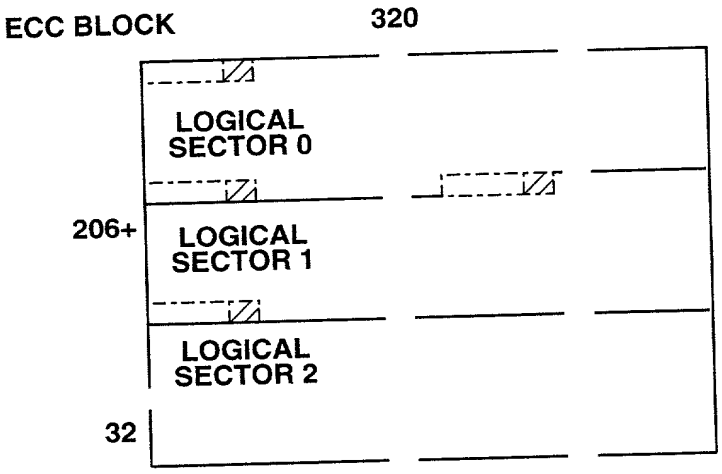
ECC BLOCK
320
LOGICAL SECTOR 0
206+
LOGICAL SECTOR 1
LOGICAL SECTOR 2
32

FIG.4

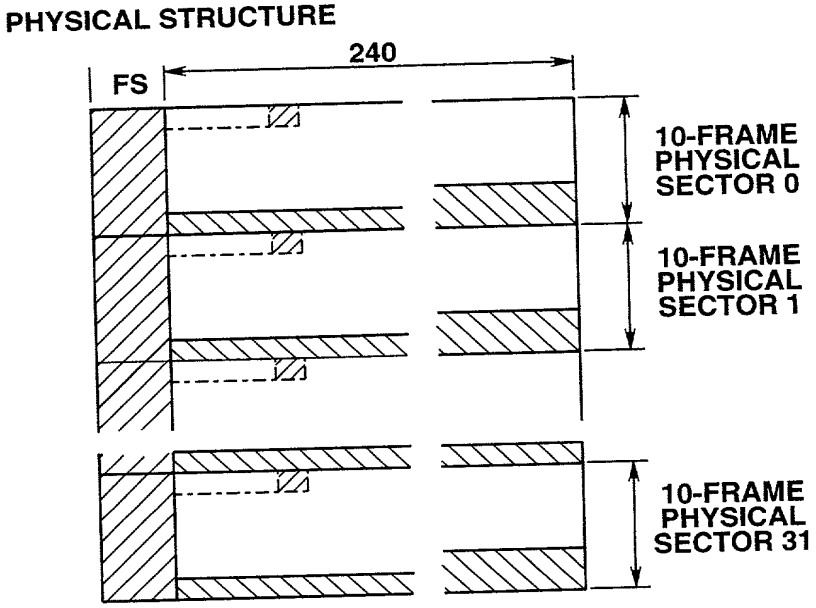
PHYSICAL STRUCTURE
240
FS
10-FRAME PHYSICAL SECTOR 0
10-FRAME PHYSICAL SECTOR 1
10-FRAME PHYSICAL SECTOR 31

FIG.5

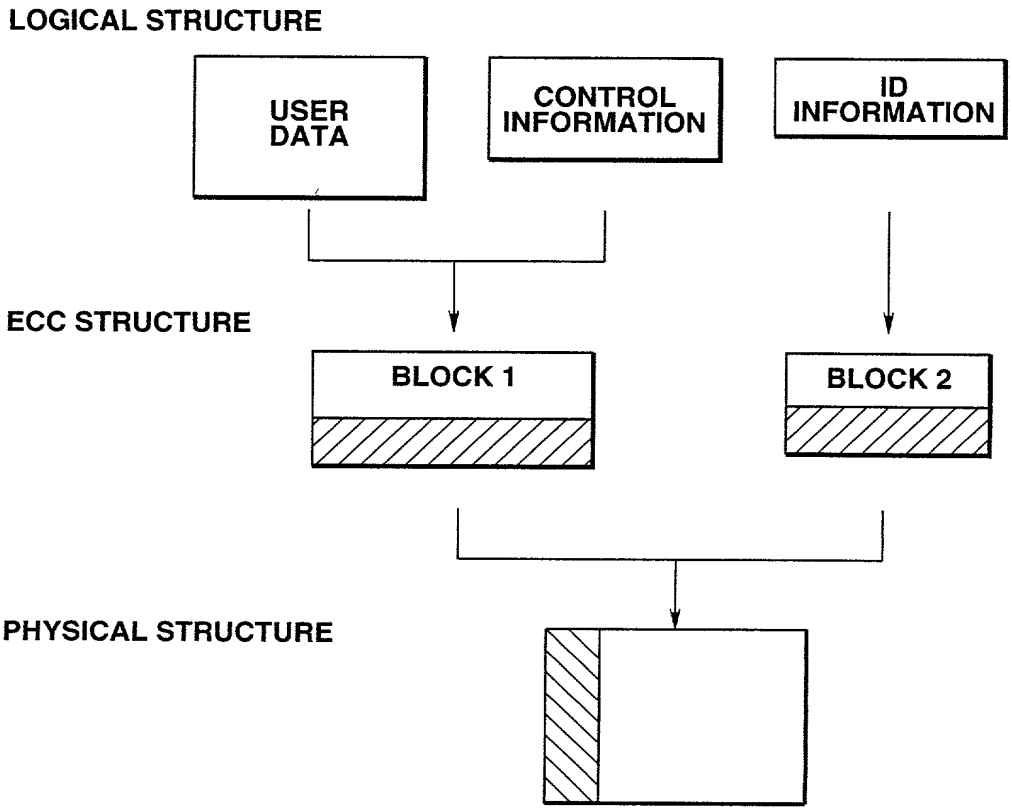
LOGICAL STRUCTURE
USER DATA
CONTROL INFORMATION
ID INFORMATION
ECC STRUCTURE
BLOCK 1
BLOCK 2
PHYSICAL STRUCTURE

FIG.6

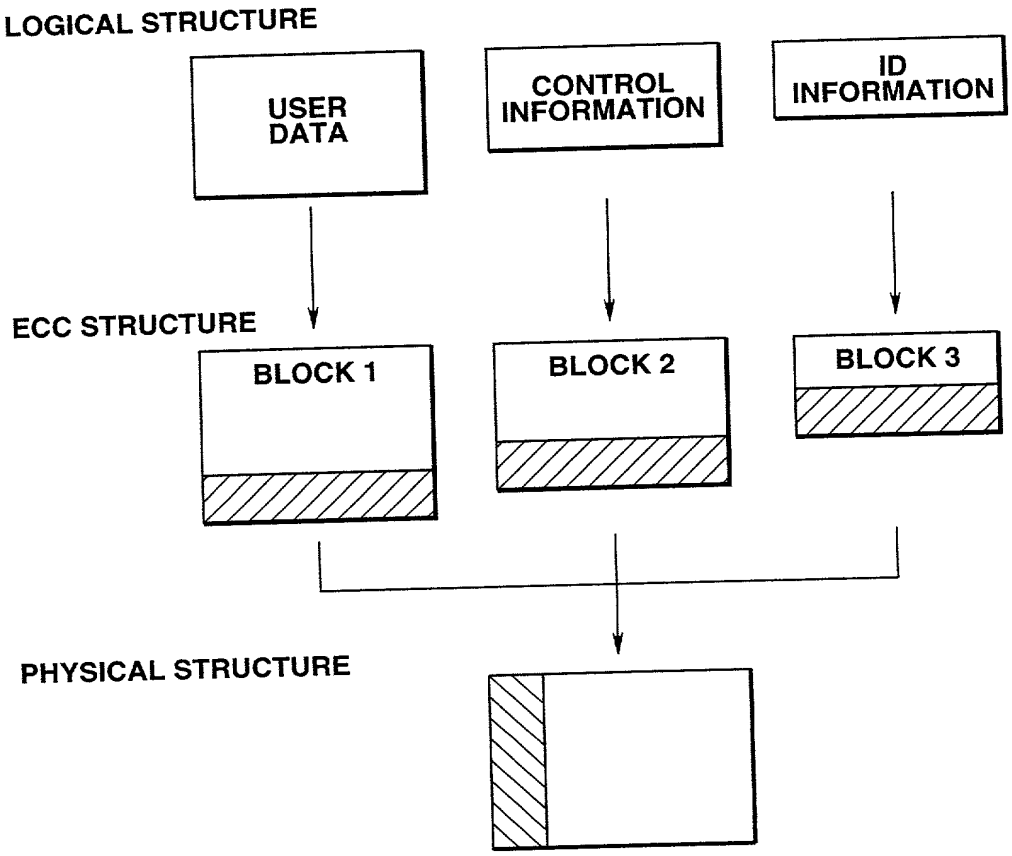
LOGICAL STRUCTURE
USER DATA
CONTROL INFORMATION
ID INFORMATION
ECC STRUCTURE
BLOCK 1
BLOCK 2
BLOCK 3
PHYSICAL STRUCTURE

FIG.7

0557709 0000360

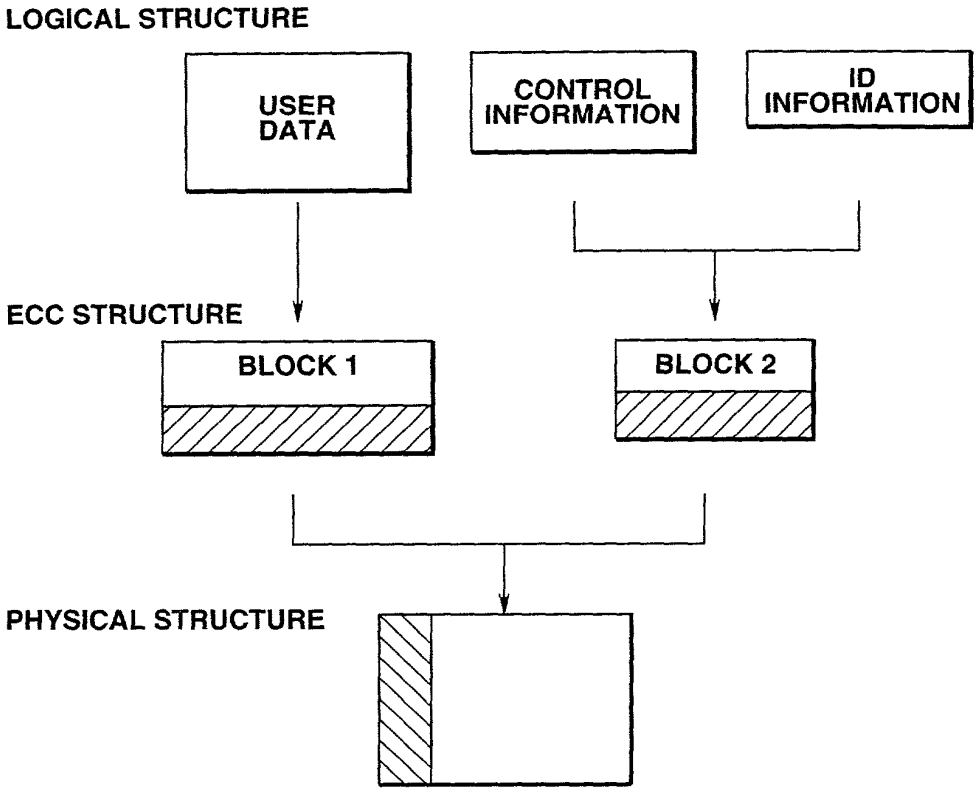

FIG.8

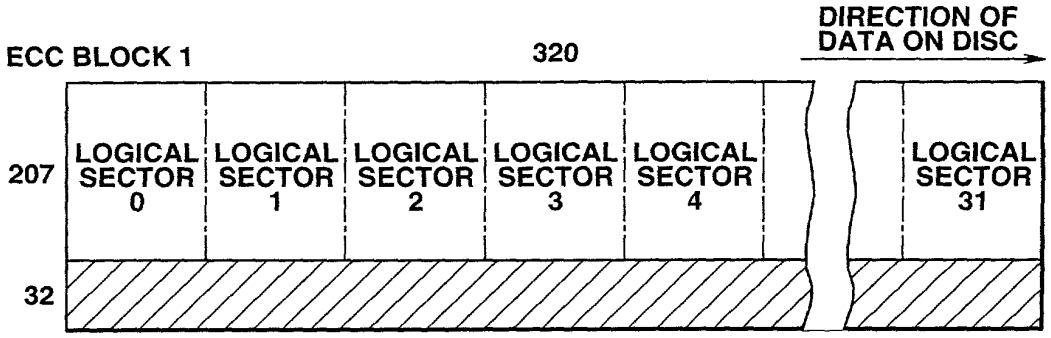

FIG.9

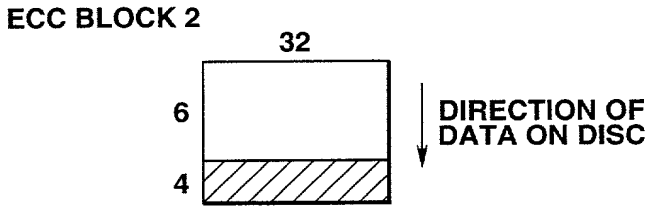
ECC BLOCK 2
32
6
4
DIRECTION OF DATA ON DISC

FIG.10

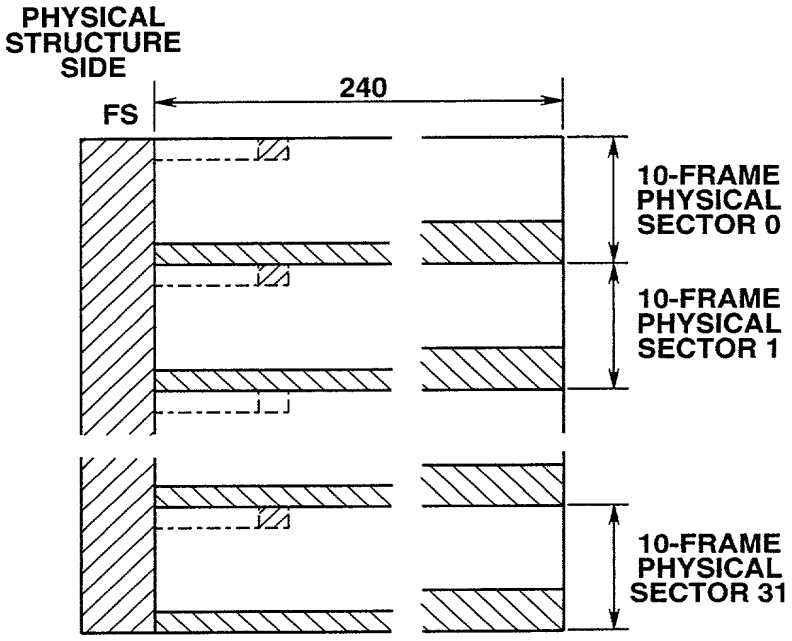
PHYSICAL STRUCTURE SIDE
FS
240
10-FRAME PHYSICAL SECTOR 0
10-FRAME PHYSICAL SECTOR 1
10-FRAME PHYSICAL SECTOR 31

FIG.11

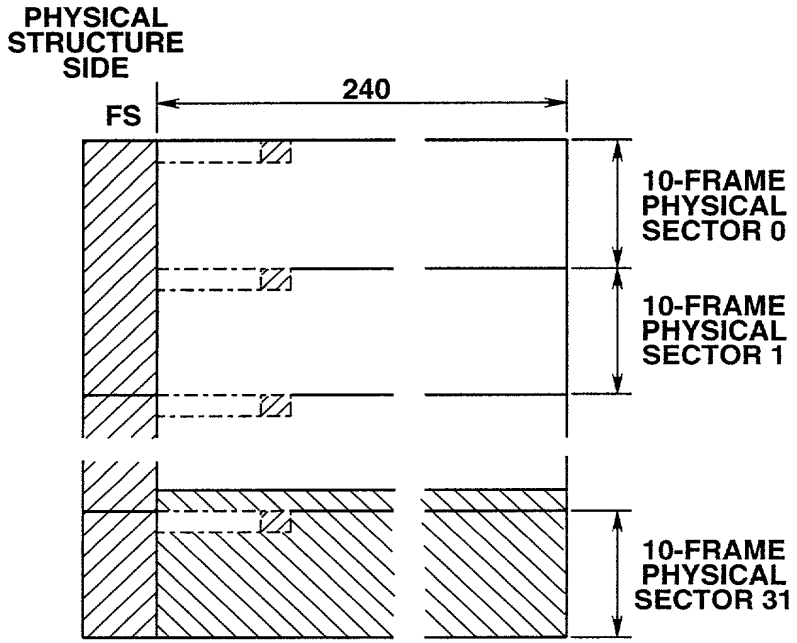
PHYSICAL
STRUCTURE
SIDE
240
FS
10-FRAME
PHYSICAL
SECTOR 0
10-FRAME
PHYSICAL
SECTOR 1
10-FRAME
PHYSICAL
SECTOR 31

FIG.12

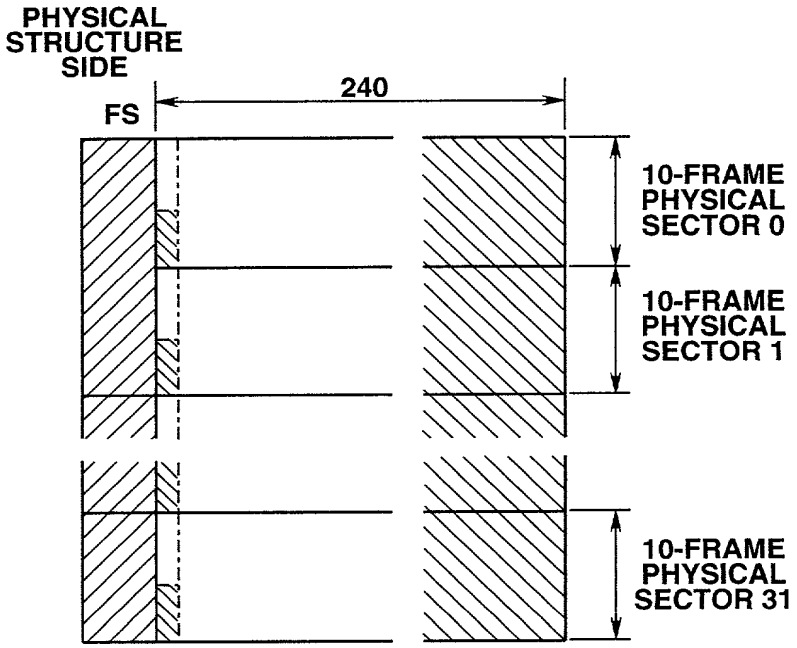
PHYSICAL
STRUCTURE
SIDE
240
FS
10-FRAME
PHYSICAL
SECTOR 0
10-FRAME
PHYSICAL
SECTOR 1
10-FRAME
PHYSICAL
SECTOR 31

FIG.13

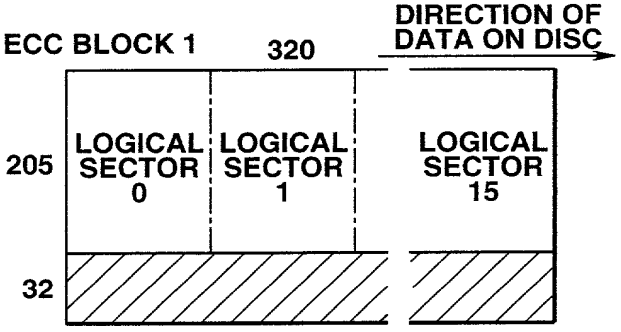
ECC BLOCK 1
320
DIRECTION OF
DATA ON DISC
205
LOGICAL
SECTOR
0
LOGICAL
SECTOR
1
LOGICAL
SECTOR
15
32

FIG.14

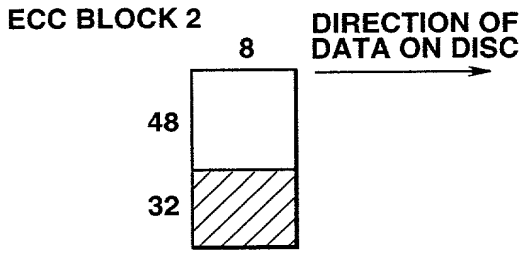
ECC BLOCK 2
8
DIRECTION OF
DATA ON DISC
48
32

FIG.15

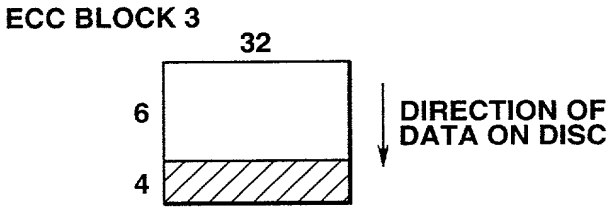
ECC BLOCK 3
32
6
4
DIRECTION OF
DATA ON DISC

FIG.16

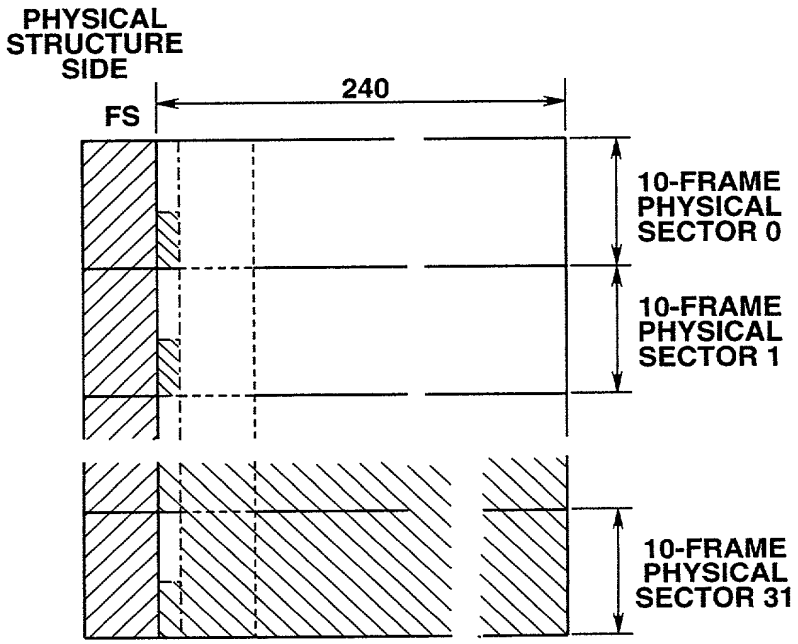
PHYSICAL
STRUCTURE
SIDE
FS
240
10-FRAME
PHYSICAL
SECTOR 0
10-FRAME
PHYSICAL
SECTOR 1
10-FRAME
PHYSICAL
SECTOR 31

FIG.17

6654201 5666560

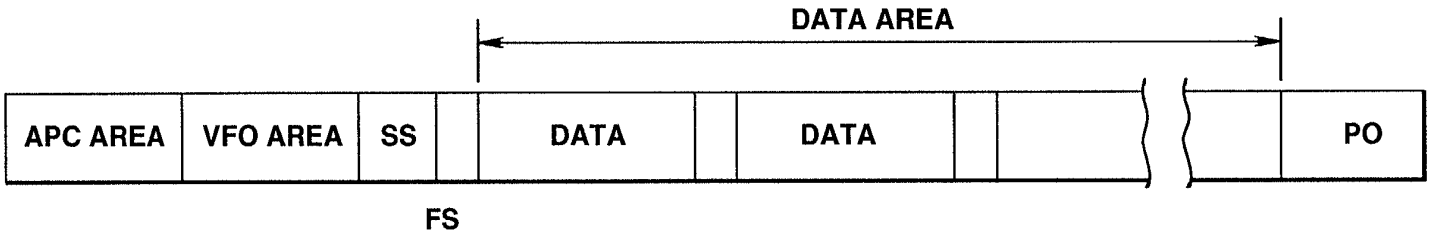

FIG.18

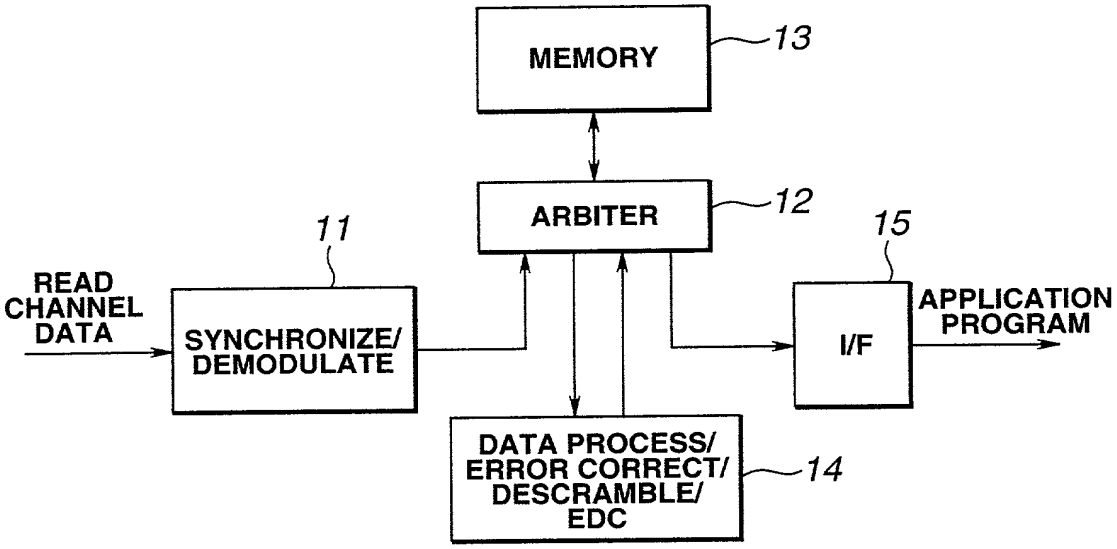
MEMORY
13
ARBITER
12
11
15
READ CHANNEL DATA
SYNCHRONIZE/ DEMODULATE
I/F
APPLICATION PROGRAM
DATA PROCESS/ ERROR CORRECT/ DESCRAMBLE/ EDC
14

FIG.19

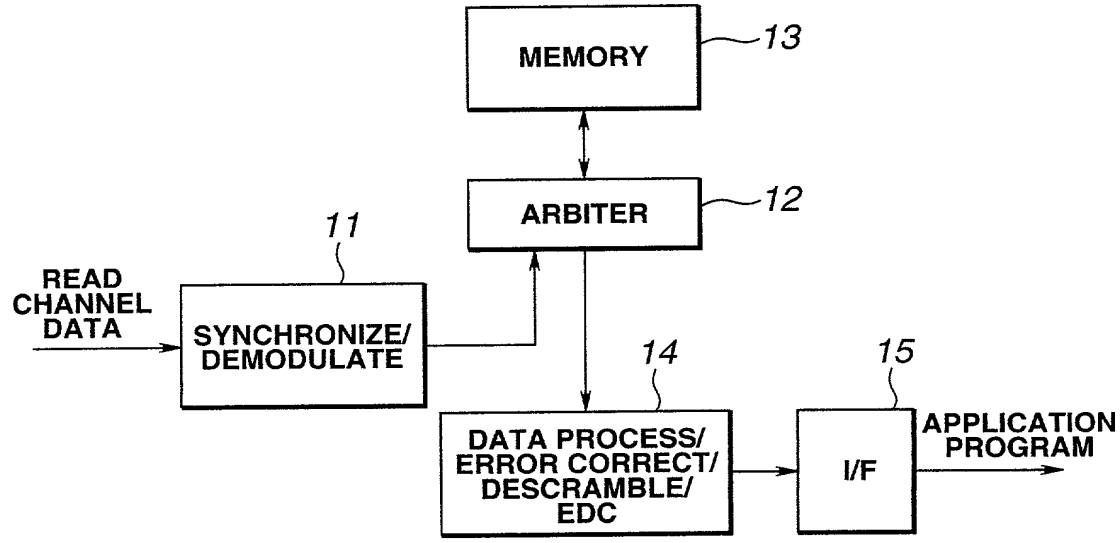
MEMORY
13
ARBITER
12
11
READ CHANNEL DATA
SYNCHRONIZE/ DEMODULATE
14
15
DATA PROCESS/ ERROR CORRECT/ DESCRAMBLE/ EDC
I/F
APPLICATION PROGRAM

FIG.20

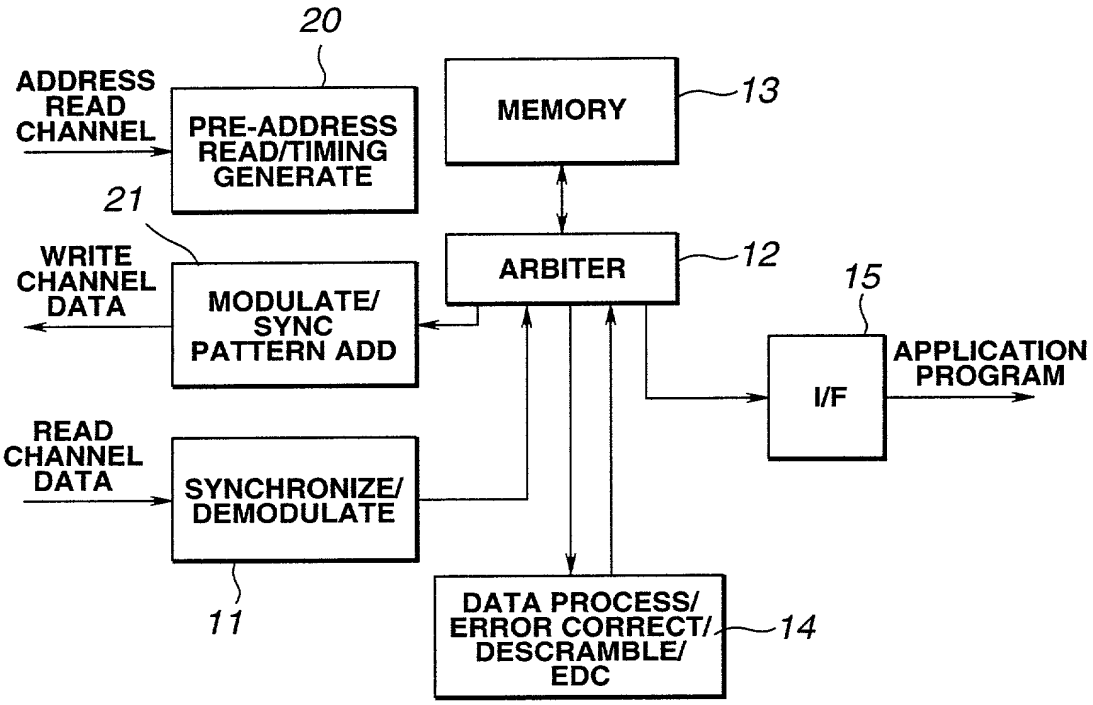
20
ADDRESS READ CHANNEL
PRE-ADDRESS READ/TIMING GENERATE
MEMORY
13
21
WRITE CHANNEL DATA
MODULATE/ SYNC PATTERN ADD
ARBITER
12
15
I/F
APPLICATION PROGRAM
READ CHANNEL DATA
SYNCHRONIZE/ DEMODULATE
11
DATA PROCESS/ ERROR CORRECT/ DESCRAMBLE/ EDC
14

FIG.21

SONY-P9817

BY EXPRESS MAIL NO. EL254064543US

Declaration and Power of Attorney For Patent Application
特許出願宣言書及び委任状

Japanese Language Declaration
日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。	As a below named inventor, I hereby declare that:
私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。	My residence, post office address and citizenship are as stated next to my name.
下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。 _____ _____	I believe I am the original, first and sole inventor (if only one named is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled. OPTICAL DISC, METHOD OF WRITE TO SAME AND METHOD OF READ FROM SAME
☐ 上記発明の明細書（下記の欄でx印がついていない場合は、本書に添付）は、 ☐ _月_日に提出され、米国出願番号または特許協定条約国際出願番号を_____とし、 （該当する場合）_____ に訂正されました。	the specification of which is attached hereto unless the following box is checked: ☐ was filed on ____ as United States Application Number or PCT International Application Number ____ and was amended on _____ (if applicable).
私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。	I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.
私は、連邦規則法典第３７編第１条５６項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。	I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.
私は、米国法典第３５編１１９条(a)-(d)項又は３６５条(b)項に基き下記の、米国以外の国の少なくとも一ヵ国を指定している特許協力条約３６５(a)項に基ずく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。	I hereby claim foreign priority under Title 35, United States Code, Section 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.
Prior Foreign Application(s) 外国での先行出願 P10-219582 (Number) （番号）　　Japan (Country) （国名）	Priority Not Claimed 優先権主張なし 17 July 1998 (Day/Month/Year Filed) （出願年月日）　　____

Japanese Language Declaration
日本語宣言書

(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)

私は、第３５編米国法典１１９条(e)項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。	I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.
(Application No.) (出願番号) (Filing Date) (出願日)	(Application No.) (出願番号) (Filing Date) (出願日)
私は、下記の米国法典第３５編１２０条に基いて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約３６５条(c)に基ずく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第３５編１１２条第１項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第３７編１条５６項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。	I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.
(Application No.) (出願番号) (Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)
(Application No.) (出願番号) (Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)
私は、私自身の知識に基ずいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じるところに基ずく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第１８編第１００１条に基ずき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。	I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may be jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration
日本語宣言書

委任状： 私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。（弁護士、または代理人の氏名及び登録番号を明記のこと）	POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark office connected therewith (*list name and registration number*)

Karl A. Limbach	18,689	Mark A Dalla Valle	34,147	Kyla L Harriel	41,816
George C. Limbach	19,305	Charles P. Sammut	28,901	Mayumi Maeda	40,075
John K. Uilkema	20,282	Mark C. Pickering	36,239	Kent J. Tobin	39,496
Neil A. Smith	25,441	Patricia Coleman James	37,155	Michael R Ward	38,651
Veronica C. Devitt	29,375	Kathleen A Frost	37,326	Roger S. Sampson	44,314
Ronald L. Yin	27,607	Alan S. Hodes	38,185	Tina Chen	P-44,606
Gerald T. Sekimura	30,103	Alan A. Limbach	39,749	Charles L Hamilton	42,624
Michael A. Stallman	29,444	Douglas C. Limbach	35,249	Andrew V. Smith	43,132
Philip A. Girard	28,848	Brian J. Keating	39,520	Heath W. Hoglund	41,076
Michael J. Pollock	29,098	Seong-Kun Oh*		William G. Goldman	42,590
Stephen M Everett	30,050	Cameron A King	41,897	J Thomas McCarthy	22,420
Alfred A. Equitz	30,922			* Recognition under 37 CFR 10.9(b)	

書類送付先	Send Correspondence to: **Charles P. Sammut, Esq.** **Limbach & Limbach L.L.P.** **2001 Ferry Building** **San Francisco, CA 94111-4262**
直接電話連絡先： （名前及び電話番号）	Direct Telephone Calls to: (*name and telephone number*) **Charles P. Sammut** **(415) 433-4150**
唯一または第一発明者名	Full name of sole or first inventor: SUSUMU SENSYU
発明者の署名 日付	Inventor's signature Date
住所	Residence Kanagawa, Japan
国籍	Citizenship Japan
私書箱	Post Office Address c/o SONY CORPORATION 7-35, Kitashinagawa 6-chome Shinagawa-ku, Tokyo, 141-0001 JAPAN